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II. THE PRINCIPAL SCIENTIFIC PAPERS.

About thirty original contributions were presented by their authors, and gave rise to more or less discussion. The papers were as follows: M. BONDIER on the influence of the soil and vegetation on the development of mushrooms; M. DANGEARD on the present status of knowledge concerning reproduction among the higher mushrooms; M. R. MAIRE on the behavior of the nucleus among mushrooms; DR. C. B. PLOWRIGHT and PROFESSOR MAGNUS on the biology of the Uredineæ; MM. CHODAT and RADAIS on the pure culture of algæ; M. CHODAT on the reactions of the nucleus to parasitism and symbiosis.

The flora of central Africa was discussed by MM. DE WILDEMAN, HUA, and A. CHEVALIER, and contrasted with that of the Amazon region, as described by M. HUBER. M. E. J. CAMUS discussed the flora of Morocco, and Dr. N. L. BRITTON gave new and interesting facts concerning the flora of the Klondike.

The physiological and anatomical papers were by MM. HOCHREUTINER, GERBER, and GIDON; while M. MARTEL presented studies on Cruciflorae, M. BEILLE on Disciflorae, M. DUTAILLY on Geum, and M. CLOS on bracts, sepals, petals, stipules, etc.

M. ANGEL GALLARDO spoke highly of the employment of the statistical method in the study of variation; while M. HUGO DE VRIES spoke upon the general subject of variation in the plant kingdom. M. PH. DE VILMORIN described a curious case of selection in *Anthriscus sylvestris;* MM. LÉVEILLE and HY spoke of hybrids; M. KRASAN treated of varieties, races, and forms; and M. GILLOT pointed out modifications which appear in local floras.

A discussion concerning the exchange of material among herbaria was participated in by MM. MOULLEFARIN, DRAKE DEL CASTILLO, and FLAHAULT.

The Congress varied the scientific conferences with visits to several collections and plantations.

NOTES ON THE FLORA OF THE BANKS AND SOUNDS AT BEAUFORT, N. C.

THE coast of North Carolina near Beaufort, like most of our Atlantic coast from Long Island southward, is bordered by a line of narrow, sandy islands, or "banks," separated from the mainland by shallow sounds from one to five miles wide. These banks vary in width from a quarter of a mile to a mile and a half, and in height from nearly sea level, in the case of certain salt marshes, to perhaps thirty feet in the case of some of the highest of the wind-blown dunes. The conditions prevailing on the higher parts of these banks are quite peculiar, for though the shifting sandy soil holds very little water, the air is very damp, since during the growing season the prevailing wind is a strong sea breeze saturated with moisture from the warm water of the Gulf Stream. Thus is to be accounted for, perhaps, the frequent occurrence here of many plants not usually found in so dry a soil, and the striking abundance of epiphytic lichens, liverworts, mosses, and ferns.

In the following pages are noted some of the interesting features of the flora of Bogue Bank and Shackleford Bank, observed during a three weeks' stay at the U. S. Fish Commission Laboratory at Beaufort, in June 1899.

The effect of physiographic agencies on the two banks above mentioned is at the present time quite different. Bogue Bank, at the point studied, seems to have reached a stage of development where it is comparatively stable. It has an outer border, or sea wall as it were, of high dunes covered with *Andropogon maritimus*, and firmly bound by its long tough rhizomes into barriers very resistant to the destructive advances of both the sea and the wind. On these dunes, growing with the Andropogon and within easy reach of the spray, are found scattered scrubby specimens of *Juniperus Virginiana* and large patches of *Ilex Cassine*, both overrun with *Ampelopsis quinquefolia*, *Rhus Toxicodendron*, *Smilax Bona-nox*, and *Melothria pendula*. Scattered among them are found *Chenopodium Botrys*, *Diodia teres*, *Œnothera humifusa*, and *Solidago sempervirens*.

As we go inward and downward from the outer crest of the dunes the forms mentioned give way to, or become mixed with, a very large number of other forms, making a flora much like that immediately to be described for Shackleford Bank.

On the latter bank, instead of the outer border of comparatively stable dunes, we find a shifting waste of wind-blown sand, stretching in a quarter of a mile or more from the water's edge, and reaching its greatest height at its inner border, where it is encroaching upon and rapidly burying what remains of the forest that once covered most of the bank.

For a hundred yards in from the water the only plants seen are the everpresent *Euphorbia polygonifolia* and small tufts of Andropogon. At the inner edge of this shifting sand plain its surface is often ten or twelve feet above the old forest floor upon which it is advancing. It ends abruptly in a steep slope down which the sand rolls after being blown along the surface of the plain.

From the foot of this slope to the inner or sound side of the bank, a distance of nearly a mile, the surface is rolling and well covered by a thick scrubby forest made up chiefly of *Quercus virens*, *Q. aquatica*, and *Q. nigra*, with *Ilex opaca*, *Morus rubra*, *Persea Carolinensis*, *Carpinus Caroliniana*, *Juniperus Virginiana*, and *Pinus Taeda*. The highest of these trees near the middle of the bank reach a height of twenty-five or thirty feet, some of the pines perhaps exceeding this limit in the wider parts of the island.

The shrubby undergrowth between these trees is made up chiefly of *Myrica Gale*, *Ilex glabra*, *Ilex Cassine*. The latter is the most abundant of all, and near the outer border of the forest often nearly equals the trees in height. The number of species in the undergrowth becomes larger as we go in from the advancing sand plain, and soon includes many herbs, the covering of vegetation being very dense from the middle of the bank inward.

The distribution of species within this area is dependent largely upon the level of the surface. Pinus, Juniperus, and Morus occur chiefly upon the elevations, while *Ilex opaca*, Carpinus, and Persea, with the three species of Quercus noted above, occupy the hollows. These trees and the shrubby undergrowth are everywhere overgrown with dense tangles of *Berchemia volubilis*, *Vitis rotundifolia*, *Rhus Toxicodendron*, *Ampelopsis quinquefolia*, *Smilax Bona-nox*, *S. tamnoides*, and *S. rotundifolia;* often also with *Cissus stans*, *Gonolobus tuberosus*, and *Melothria pendula*.

Where the vegetation is densest, the trunks and branches of the trees and shrubs are covered with epiphytes. *Polypodium incanum* forms straggling clumps, usually on *Quercus virens*, but occasionally on the other oaks or even on the pine, becoming well established only when the tree is old enough to have a pretty rough bark. Species of Frullania, Liochlaena, Lejeunia, and Archilejeunia, form reddish or yellowish patches on the trunks of the trees, or in the case of one or two species, the delicate branches creep at the very bottoms of the deep grooves in the rough bark. Lichens, in great variety for so restricted an area, cover every available surface. On the oaks, pines, and mulberries occur Parmelia, Ramalina, Usnea, and other fruticose and foliaceous forms, while the smooth barked hollies, Persea, and Myrica are literally covered from the trunk out to branches of only two or three years' growth with crustaceous Placodiums, Buellias, Lecidias, and others, in great variety of form and outline. One of the most striking species, occurring chiefly on the holly, forms brilliant blood red patches as large as the hand. A trunk blotched with this, intermingled with others of various shades of yellow, green, brown, and black, each patch with its clear, black outline, and often dotted with fruits of a different color, is a veritable mosaic of color.

In the lowest portions, near the middle of the banks, occur small pools of dirty water, bordered with sedges and grasses, and often also with stemless palmettos (*Sabal Adansonia*). In other, often well shaded, hollows dense patches of *Saururus cernuus* are found, and still other more open ones are completely covered with the gigantic *Sagittaria lancifolia*. Finally, among the shrubs and other herbs of these hollows are found three of the five pteridophytes seen on the banks. Those occurring here are *Aspidium Thelypteris*, *Onoclea sensibilis*, and *Osmunda regalis*. Of the other two, *Asplenium ebeneum* occurs on the drier shaded portions, and *Polypodium incanum*, as noted above, is an epiphyte.

At the inner edge of the encroaching sand plain the process of burying the old surface of the bank can be seen in all stages of progress. Just in from the foot of the slope, that is, on the outer border of the forest, many of the trees are seen to be dead, though the sand has not yet touched them. The junipers and yaupons, however, persist, and even when buried to the waist in the slope of drifting sand still look fresh and green at the top. As one goes seaward from this border between the shifting sand and the forest, these few green tops finally disappear, and then for one hundred and fifty yards or more one finds only the dead tops of trees of which all but the upper third, that is about six or eight feet, have been buried by the sand. Of these tree tops those nearest the existing forest are mostly denuded of bark, and then a little farther out one sees that the soft sapwood has been entirely carved away by the furious blasts of sand. Yet in many cases, a hundred feet from the edge of the sand slope, they are still capped by dense mats of Berchemia, Ampelopsis, or Rhus, and on the leeward side of the branches many lichens still flourish.

In the comparatively few days spent in examining these banks it became evident that many ecological problems are here presented for solution. Interesting results ought certainly to be gained from a comparison of the distribution and anatomical structure of the forms occurring here with those of the same or similar forms on others of these banks farther north, where the atmospheric moisture conditions must, it would seem, be quite different.

In all nearly a hundred vascular plants were collected and identified, chiefly by Mr. W. C. Coker.

NOTE ON THE ALGÆ OF BOGUE AND CORE SOUNDS.

The nature of the bottom of the ocean and sounds near Beaufort is such as to provide few habitats of the sort most frequented by marine algae. There are no rocks whatever, except one or two stone wharves near the town, and several short breakwaters near the inlet from the ocean. Rock pebbles even are practically wanting, any as large as a pea being seldom found on the natural beaches. It will not be surprising, therefore, to find that the algal flora is comparatively poor in species, and is made up in numbers chiefly of those forms which attach themselves to shells lying on the sandy or muddy bottom.

Probably the most abundant alga in the sounds, except possibly *Ulva lactuca*, is *Hypnea musciformis*, which grows in thick snarled tufts on every available substratum. Scattered quite generally among the latter are tufts of *Dictyota dichotoma*, here near its northern limit, together with abundant specimens of *Rhabdonia tenera* and *Gracillaria confervoides*.

Codium tomentosum sometimes also occurs on shells in the sounds, but is much more frequent on the rocks of the breakwaters. On these same rocks we find Dictyota in abundance, often accompanied by the related form *Padina pavonia*. More abundant than all other algæ here, however, is *Sargassum vulgare*, which covers the inner breakwaters with thick tufts half a yard in length. On the Sargassum and the much less frequent Fucus, *Ectocarpus siliqulosus* and other Ectocarpus species are very abundant. Among the coarser forms, especially on the more exposed parts of the breakwater, grow Enteromorpha and most of the more delicate Rhodophyceæ that are found near Beaufort. Chief among the latter are *Dasya elegans*, *Erythrotrichia ceramicola*, *Gelidium crinale*, *Grinnellia Americana*, and *Trentepohlia virgatula*, with several species each of Callithamnion, Ceramium, and Polysiphonia.

On the leaves of *Zostera marina*, which abounds throughout the sounds *Melobesia pustulata* and probably other species are very common.

Altogether between twenty-five and thirty species were found, the most interesting feature of the flora being perhaps the occurrence here, at what must be nearly their northern limit, of the tropical or subtropical forms Codium, Dictyota, and Padina.—DUNCAN S. JOHNSON, *Johns Hopkins University.*

NOTES ON THE VALIDITY OF ASPLENIUM EBENOIDES AS A SPECIES.[1]

A RECENT visit, in company with Mr. Charles L. Pollard, to the somewhat famous locality for this fern at Havana, Hale county, Alabama, has led me to review what has been written upon the question of its hybridity, and to offer here a few comments, both upon its occurrence in Alabama and regarding its status as a species.

The theory of the hybridity of *Asplenium ebenoides* originated with Berkeley,[2] when, in publishing Scott's manuscript name in 1866, he expressed an opinion that the fern might well be a hybrid between *Asplenium ebeneum* and *Camptosorus rhizophyllus.* No considerable amount has since been written, but, considering the scattering references available, I think it may fairly be said that the weight of authority has been in support of Berkeley's proposition. Professor Coulter, in mentioning the discovery (1882) of new stations for this "suspicious species," remarked[3] that the "burden of testimony all seems to be in favor of that idea." Both Mr. Redfield[4] and Professor Eaton[5] regarded the fern as a probable hybrid; while the most concise favorable comment is that of Mr. George E. Davenport,[6] who cites it as "probably the best example of a fern hybrid that we have, the infrequency of its occurrence, the presence always of *Camptosorus* and *Asplenium ebeneum*, and the few plants found in the recorded stations, all going to favor the hypothesis of hybridization." In 1896 Professor Underwood, having visited the Havana locality, made the statements,[7]

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[1] Published by permission of the Secretary of the Smithsonian Institution.

[2] Journn. Roy. Hort. Soc. 87. *pl. 2, fig. 1.* 1866.

[3] BOT. GAZ. **7** : 37. 1882.

[4] Proc. Acad. Nat. Sci., Phila. Dec. 1874.

[5] Ferns of N. Am. **1** : 26.

[6] BOT. GAZ. **19** : 492 *et seq.* 1894.

[7] BOT. GAZ. **22** : 410. 1896.